

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY



(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference CDK2174		FOR FURTHER ACTION		See Form PCT/PEA/416
International application No. PCT/GB2004/002660		International filing date (day/month/year) 21.06.2004		Priority date (day/month/year) 20.06.2003
International Patent Classification (IPC) or national classification and IPC C02F1/50, C02F11/00				
Applicant RHODIA CONSUMER SPECIALTIES LIMITED				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 8 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 5 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains Indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input checked="" type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input checked="" type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand 19.04.2005		Date of completion of this report 03.11.2005		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer González Arias, M Telephone No. +31 70 340-2054 		

**INTERNATIONAL PRELIMINARY REPORT
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International application No.
PCT/GB2004/002660

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-10 as originally filed

Claims, Numbers

1-29 filed with telefax on 19.04.2005

Drawings, Sheets

1/3-3/3 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 28, 29

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 28, 29

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

☐ has not been furnished

☐ does not comply with the standard

the computer readable form

☐ has not been furnished

☐ does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

**INTERNATIONAL PRELIMINARY REPORT
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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-26
	No: Claims	27
Inventive step (IS)	Yes: Claims	1-26
	No: Claims	27
Industrial applicability (IA)	Yes: Claims	1-27
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

No examination of claims 28 and 29 is performed because no search report for those claims has been established as they do not meet the requirements of Rule 6.2(a) PCT.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: US-A-5 422 015 (ANGELL EDWIN C ET AL) 6 June 1995 (1995-06-06)

D2: EP-A-0 215 562 (ALBRIGHT & WILSON) 25 March 1987 (1987-03-25)

- 1: The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 27 is not new in the sense of Article 33(2) PCT.

Claim 27 refers to a product (sewage sludge) defined in terms of a process. Such

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sludge with reduced pathogen content. Such sludge is known from D1 (column 1, lines 5-12).

Therefore the subject-matter of claim 27 is not new (Article 33(2) PCT).

2. The subject-matter of claims 1-26 as far as it can be understood (see Item VIII) fulfills the requirements of Article 33(2) PCT (Novelty).

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1 and shows a method to reduce the pathogen content of sludge by adding an amount of phosphorus containing compound (phosphoric acid).

The subject-matter of claim 1 differs from this known process in that the compound added to the sludge is a phosphonium compound of formula (I) or an alkyl-substituted phosphine of formula (II).

The subject-matter of claims 1-26 is therefore new (Article 33(2) PCT).

3. The subject-matter of claims 1-26 as far as it can be understood (see Item VIII) fulfills

the requirements of Article 33(3) PCT (Inventive Step).

The difference of the subject-matter of claim 1 and D1 is the addition of a phosphonium compound of formula (I) or an alkyl-substituted phosphine of formula (II) to the sludge. The problem to be solved is to reduce in an efficient way the pathogen content of sewage sludge before it is spread to land.

As shown in the examples 1 to 3 of the application said problem is solved with the compounds according to claim 1 of the application.

Although document D2 discloses the use of phosphonium salts used as surfactants, mixed with a phosphine to fight against microbial contamination in industrial cooling or process water (claims 14 and 15), no indication is given about the use of phosphonium salts or alkyl-substituted phosphine of formula (II) to eliminate pathogens or to disinfect sewage sludge. The subject-matter of claim 1 is therefore inventive.

Consequently the subject-matter of claims 2-26 also involves an inventive step.

Re Item VIII

Certain observations on the international application

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 is not mentioned in the description, nor are this these documents identified therein.

Re Item VIII

Certain observations on the international application

The expression "to reduce the amount of pathogens.....of 2 or more" is considered a result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result. Clear steps to perform the method of claim 1 should be given. It is clear from the description that the amount of compound used (see examples) and the concentration of it is an essential feature to perform the method of claim 1. The requirements of Article 6 PCT are therefore not met.

CLAIMS

1. A method of treating sewage sludge to reduce the pathogen content of said sludge, the method comprising the steps of:

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(a) adding to the sludge an effective amount of a phosphorus-containing compound, wherein the phosphorus-containing compound is a phosphonium compound, wherein the phosphonium compound is either:

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- (i) a tetrakis(hydroxyorgano)phosphonium salt; or
- (ii) a compound of formula (I)



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wherein:

n is the valency of X;

R' and R'', which may be the same or different, are selected from an alkyl, hydroxyalkyl, alkenyl or aryl moiety and X is an anion; or

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wherein:

the phosphorus-containing compound is an alkyl-substituted phosphine as shown in formula (II):

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wherein:

each R, which may be the same or different, is selected from an alkyl, hydroxyalkyl, alkenyl or aryl moiety; and

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- (b) keeping the phosphorus-containing compound in contact with the sludge for sufficient time to reduce the amount of pathogens present in the sludge by an amount equivalent to a logarithmic reduction of 2 or more.

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2. A method as claimed in claim 1 in which the log reduction of 2 or more is achieved over a 24-hour period.

3. A method as claimed in claim 1 in which the phosphorus-containing compound is kept in contact with the sludge for sufficient time to reduce the amount of pathogens present in the sludge by a log reduction of 3 or more.

4. A method as claimed in claim 3 in which the phosphorus-containing compound is kept in contact with the sludge for sufficient time to reduce the amount of pathogens present in the sludge by a log reduction of 4 or more.

5. A method as claimed in any one of the preceding claims in which the pathogens are bacteria.

6. A method as claimed in any one of the preceding claims in which the sludge has undergone anaerobic digestion prior to step (a).

7. A method as claimed in any one of the preceding claims in which R' and R'' are between 1 and 20 carbon atoms in length.

8. A method as claimed in any one of the preceding claims in which X is selected from the group consisting of chloride, sulphate, phosphate, acetate, oxalate and bromide.

9. A method as claimed in any one of the preceding claims in which the phosphonium compound is tetrakis(hydroxymethyl) phosphonium sulphate.

5 10. A method as claimed in any one of the preceding claims in which the phosphonium compound is selected from tetrakis(hydroxymethyl) phosphonium chloride, tetrakis(hydroxymethyl)phosphonium bromide, tetrakis(hydroxymethyl)phosphonium phosphate, tetrakis (hydroxymethyl) phosphonium acetate or tetrakis(hydroxymethyl)phosphonium oxalate.

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11. A method as claimed in any one of the preceding claims in which the amount of phosphorus-containing compound to be added to the sludge in step (a) of the method of the present invention is up to 10000mg/l.

15 12. A method as claimed in claim 11 in which the amount of phosphorus-containing compound to be added to the sludge in step (a) of the method of the present invention is 100-2500mg/l.

20 13. A method as claimed in claim 12 in which the amount of phosphorus-containing compound to be added to the sludge in step (a) of the method of the present invention is 200-1000mg/l.

25 14. A method as claimed in any one of claims 1 to 10 in which the amount of phosphorus-containing compound to be added to the sludge is expressed relative to dry solids weight and the amount to be added is up to about 30% by weight of dry solids.

30 15. A method as claimed in claim 14 in which the amount of phosphorus-containing compound to be added is from 0.1 to 20% by weight of dry solids.

16. A method as claimed in claim 15 in which the amount of phosphorus-containing compound to be added is from 0.1 to 10% by weight of dry solids.
- 5 17. A method as claimed in claim 14 in which the amount of phosphorus-containing compound to be added is from 0.2 to 5% by weight of dry solids.
- 10 18. A method as claimed in claim 14 in which the amount of phosphorus-containing compound to be added is from 0.4 to 2% by weight of dry solids.
- 15 19. A method as claimed in any one of the preceding claims in which step (b) of the method of the present invention is carried out over a period of from 1 second to 14 days.
- 20 20. A method as claimed in claim 19 in which step (b) of the method of the present invention is carried out over a period of from 6 to 24 hours.
- 20 21. A method as claimed in claim 19 in which step (b) of the method of the present invention may be carried out over a period of from 15 seconds to 24 hours.
- 25 22. A method as claimed in any one claims 1 to 4 and claims 6 to 21 in which the pathogens present in the sludge are selected from the group consisting of bacteria, viruses, protozoans and helminths.
- 30 23. A method as claimed in claim 5 and 22 in which the bacteria are selected from the group consisting of *Escherichia coli*, *Salmonella spp.*, *Shigella spp.*, *Vibrio cholerae*, *Bacillus cereus*, *Listeria monocytogenes*, *Campylobacter spp.* and *Yersinia pestis*.

24. A method as claimed in claim 22 in which the viruses are selected from the group consisting of rotaviruses, calciviruses, group F adenoviruses and astroviruses.

5 25. A method as claimed in claim 22 in which the protozoans are selected from the group consisting of *Entamoeba spp.*, *Giardia spp.*, *Balantidium coli* and *Cryptosporidium spp.*

10 26. A method as claimed in claim 22 in which the helminths are selected from the group consisting of *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), *Ancylostoma duodenale* (hookworm), *Strongyloides stercoralis* (threadworm), *Schistosoma spp.*, *Taenia saginata* (beef tapeworm), *Taenia solium* (pork tapeworm) and their eggs.

15 27. A sewage sludge that has been treated according to the method as claimed in any one of claims 1 to 26.

20 28. A method of treating sewage sludge substantially as described herein with reference to the accompanying examples and figures.

25 29. A treated sludge substantially as described herein with reference to the accompanying examples and figures.